

LEGOS EXPERIMENTS

Background Information

Using Legos or some type of building blocks, we can actually simulate problems and concerns that many astronauts must face while conducting experiments in space. With the building blocks, students can experience the difficulties of engineers during a space mission. Here are some experiments that can be done in the classroom.

Objectives

Upon completion of this lesson, students will be able to:

- develop good communication and problem-solving techniques.
- practice skills similar to astronaut EVA practices.

Instruction Time

30–45 minutes (depending on number of experiments conducted)

Materials

Experiment 1 – Simple Object

Legos (make sure there are two of everything to build and copy)
Divider/Separate construction areas
Video Camera
Television Monitor
Paper & Pencil (for written directions)

Experiment 2 – Simple Object, One Glove

Legos (make sure there are two of everything to build and copy)
Divider/Separate construction areas
Heavy glove (welding/farm use glove)
Video Camera
Television Monitor
Paper & Pencil (for written directions)

Experiment 3 – Simple Object, Two Gloves

Legos (make sure there are two of everything to build and copy)
Divider/Separate construction areas
Heavy glove (welding/farm use glove)
Video Camera
Television Monitor
Paper & Pencil (for written directions)

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Experiment 4 – Simple Object, Two Gloves

Legos (make sure there are two of everything to build and copy)
Divider/Separate construction areas
Heavy glove (welding/farm use glove)
Stopwatch
Video Camera
Television Monitor
Paper & Pencil (for written directions)

Experiment 5 – Making Two Parts

Legos (make sure there are two of everything to build and copy)
Divider/Separate construction areas
Heavy glove (welding/farm use glove)
Video Camera
Television Monitor
Paper & Pencil (for written directions)

Experiment 6 – Facility Design

Legos (make sure there are two of everything to build and copy)
Divider/Separate construction areas
Heavy glove (welding/farm use glove)
Video Camera
Television Monitor
Paper & Pencil (for written directions)

Experiment 7 – Docking (Shuttle to ISS)

Legos (make sure there are two of everything to build and copy)
Divider/Separate construction areas
Heavy glove (welding/farm use glove)
Video Camera
Television Monitor
Paper & Pencil (for written directions)

Experiment 8 – Using Tools in Space

Legos (make sure there are two of everything to build and copy)
Divider/Separate construction areas
Heavy glove (welding/farm use glove)
Two pairs of pliers
Video Camera
Television Monitor
Paper & Pencil (for written directions)

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Experiment 9 - Tools and Balance in Space

Legos (make sure there are two of everything to build and copy)

Divider/Separate construction areas

Heavy glove (welding/farm use glove)

Two pairs of pliers

Balance Beam

Video Camera

Television Monitor

Paper & Pencil (for written directions)

Procedures

Experiment 1 - Simple Object

1. Instruct the Mission Control team to create an object with the Legos.
2. Mission Control personnel explain to the astronauts how to create the same object from a package of necessary Lego pieces.
3. This experiment demonstrates to students astronauts and student Mission Control personnel how difficult it is to give and follow directions when the builder can't see the original piece.
4. If available, set up a camera and television in order for the student astronauts to see the Mission Control object.
5. Some space shuttle simulators have television cameras that allow Mission Control to monitor the astronauts, so astronauts can hold their final pieces up for a check.
6. Since the real astronauts could do the same, this is fine.
7. It's sometimes interesting NOT to use the camera; however, Mission Control personnel sometimes find it difficult to give good directions, but with practice and discussion among the Mission Control staff, students will develop efficient techniques.

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Experiment 2 – Simple Object, One Glove

1. Instruct the Mission Control team to create an object with the Legos.
2. Mission Control personnel explain to the astronauts how to create the same object from a package of necessary Lego pieces.
3. Student astronauts should wear one glove while constructing their Lego object.
4. In addition to practicing the skill of giving and following directions, the student astronauts start to simulate the problems astronauts have when working with the heavy gloves contained in space suits.
5. If available, set up a camera and television in order for the student astronauts to see the Mission Control object.
6. Some space shuttle simulators have television cameras which allow Mission Control to monitor the astronauts, so astronauts can hold their final pieces up for a check.
7. Since the real astronauts could do the same, this is fine.
8. It's sometimes interesting NOT to use the camera; however, Mission Control personnel sometimes find it difficult to give good directions, but with practice and discussion among the Mission Control staff, students will develop efficient techniques.

Experiment 3 – Simple Object, Two Gloves

1. Instruct the Mission Control team to create a complex object with the Legos.
2. Mission Control personnel explain to the astronauts how to create the same object from a package of necessary Lego pieces.
3. Student astronauts should wear two gloves while constructing their Lego object.
4. Having practiced building an object wearing one glove, they are now ready to work with a glove on each hand – furthering their understanding of the difficulties of working in space wearing thick gloves.
5. If available, set up a camera and television in order for the student astronauts to see the Mission Control object.
6. Some space shuttle simulators have television cameras which allow Mission Control to monitor the astronauts, so astronauts can hold their final pieces up for a check.
7. Since the real astronauts could do the same, this is fine.
8. It's sometimes interesting NOT to use the camera; however, Mission Control personnel sometimes find it difficult to give good directions, but with practice and discussion among the Mission Control staff, students will develop efficient techniques.

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Experiment 4 - No Gloves, One Glove, Two Gloves

1. Instruct the Mission Control team to create a complex object with Legos.
2. Mission Control personnel explain to the astronauts how to create the same object from a package of necessary Lego pieces.
3. Students use control groups to test a hypothesis: building an object is most difficult with two gloves, less difficult with one glove, and easiest with no gloves. Although the hypothesis is a simple and perhaps obvious one, it provides a “hands-on” demonstration of control groups.
4. Students will build the object 3 times, recording their timing after each construction. Then, determine if their hypothesis is correct.
5. If available, set up a camera and television in order for the student astronauts to see the Mission Control object.
6. Some space shuttle simulators have television cameras which allow Mission Control to monitor the astronauts, so astronauts can hold their final pieces up for a check.
7. Since the real astronauts could do the same, this is fine.
8. It's sometimes interesting NOT to use the camera; however, Mission Control personnel sometimes find it difficult to give good directions, but with practice and discussion among the Mission Control staff, students will develop efficient techniques.

Experiment 5 - Making two parts

1. Instruct the Mission Control team to create an object with the Legos that consists of two parts.
2. Mission Control personnel explain to the astronauts how to create the same object from a package of necessary Lego pieces.
3. Once each piece is completed, Mission Control explains how to join the two pieces. This experiment adds a little to the complexity of the directions and the need for careful listening, and it demonstrates a simple assembly operation of the type which astronauts often have to perform when assembling equipment.
4. If available, set up a camera and television in order for the student astronauts to see the Mission Control object.
5. Some space shuttle simulators have television cameras which allow Mission Control to monitor the astronauts, so astronauts can hold their final pieces up for a check.
6. It's sometimes interesting NOT to use the camera; however, Mission Control personnel sometimes find it difficult to give good directions, but with practice and discussion among the Mission Control staff, students will develop efficient techniques.

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Experiment 6 - Facility Design

1. Instruct the Mission Control team to create a moon bases, Mars base, or even a satellite with the Legos.
2. Mission Control personnel explain to the astronauts how to create the same object from a package of necessary Lego pieces.
3. If available, set up a camera and television in order for the student astronauts to see the Mission Control object.
4. Some space shuttle simulators have television cameras which allow Mission Control to monitor the astronauts, so astronauts can hold their final pieces up for a check.
5. Since the real astronauts could do the same, this is fine.
6. It's sometimes interesting NOT to use the camera; however, Mission Control personnel sometimes find it difficult to give good directions, but with practice and discussion among the Mission Control staff, students will develop efficient techniques.
7. At the end of the mission students can bring their design out and explain it to classmates.

Experiment 7 - Docking (Shuttle to ISS)

1. Instruct the Mission Control team to create two objects, one of which fits into the other.
2. Mission Control then writes up these directions (with dimensions) to provide to the two teams of astronauts.
3. If Mission Control is not used, each team must create a component, which will dock with the other team's component. Each team is encouraged to talk to the other team and discuss the problem.
4. The extent of the instructions can vary, depending on the abilities of the student astronauts or the degree to which you want the experiment to be challenging.
5. If available, set up a camera and television in order for the student astronauts to see the Mission Control object.
6. Some space shuttle simulators have television cameras which allow Mission Control to monitor the astronauts, so astronauts can hold their final pieces up for a check.
7. Since the real astronauts could do the same, this is fine.
8. It's sometimes interesting NOT to use the camera; however, Mission Control personnel sometimes find it difficult to give good directions, but with practice and discussion among the Mission Control staff, students will develop efficient techniques.

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Experiment 8 - Using Tools in Space

1. Instruct the Mission Control team to create an object with the Legos.
2. Mission Control personnel explain to the astronauts how to create the same object from a package of necessary Lego pieces.
3. This experiment demonstrates to students astronauts and student Mission Control personnel how difficult it is to give and follow directions when the builder can't see the original piece.
4. For this activity, astronauts are wearing gloves, but they can't use their fingers in the construction. They must use pliers, one pair in each hand.
5. If available, set up a camera and television in order for the student astronauts to see the Mission Control object.
6. Some space shuttle simulators have television cameras that allow Mission Control to monitor the astronauts, so astronauts can hold their final pieces up for a check.
7. Since the real astronauts could do the same, this is fine.
8. It's sometimes interesting NOT to use the camera; however, Mission Control personnel sometimes find it difficult to give good directions, but with practice and discussion among the Mission Control staff, students will develop efficient techniques.

Experiment 9 - Tools and Balance in Space

1. Instruct the Mission Control team to create an object with the Legos.
2. Mission Control personnel explain to the astronauts how to create the same object from a package of necessary Lego pieces.
3. For this activity, astronauts are wearing gloves, but they can't use their fingers in the construction. They must use pliers, one pair in each hand while standing on a balance beam.
4. Using this procedure adds additional reality to astronauts working in space with tools. Remember the capture of the satellite done by the astronauts while working on the shuttle arm?
5. If available, set up a camera and television in order for the student astronauts to see the Mission Control object.
6. Some space shuttle simulators have television cameras that allow Mission Control to monitor the astronauts, so astronauts can hold their final pieces up for a check.
7. Since the real astronauts could do the same, this is fine.
8. It's sometimes interesting NOT to use the camera; however, Mission Control personnel sometimes find it difficult to give good directions, but with practice and discussion among the Mission Control staff, students will develop efficient techniques.